

CLAIMS

What is claimed is:

1. A wind blade spar cap for strengthening a wind blade comprising:

an integral, unitary three-dimensional woven material having a first end and a second end, corresponding to a root end of the blade and a tip end of the blade, wherein the material tapers in width from the first to the second end while maintaining a constant thickness and decreasing weight therebetween, the cap being capable of being affixed to the blade for providing increased strength with controlled variation in weight from the root end to the tip end based upon the tapered width of the material thereof.
2. The spar cap of claim 1, wherein the material comprises carbon fibers.
3. The spar cap of claim 1, wherein the material comprises E-glass filaments.
4. The spar cap of claim 1, wherein the material is a hybrid of carbon and E-glass filaments.
5. The spar cap of claim 1, wherein the material is resin-infused.
6. The spar cap of claim 1, wherein the 3-D woven structure includes 3-D orthogonal yarn systems.
7. The spar cap of claim 1, wherein
8. The spar cap of claim 1, wherein
9. The spar cap of claim 1, wherein
10. A method of making a wind blade spar cap comprising the steps of:

providing a plurality of yarn systems for supplying input to a weaving machine;

introducing the yarn to the machine for manipulation in each of x-, y-, and z- directions, where the directions produce intersecting points;

forming an integral, unitary three-dimensional woven material having a predetermined, controlled thickness from the yarn where the x- and y-direction yarns are disposed to each other without interlacing, and where the z-direction yarns are manipulated to secure the x- and y-direction yarns in respective planes;

cutting the material to form a tapered spar cap section;

applying the tapered section to a wind blade such that the taper direction of the section decreases from a root end of the blade to a tip end of the blade.

11. The method of claim 10, further including the step of introducing a resin to the section prior to applying it to the blade.

12. A wind blade comprising:

a spar cap further comprising an integral, unitary three-dimensional woven material having a first end and a second end, corresponding to a root end of the blade and a tip end of the blade, wherein the material tapers in width from the first to the second end while maintaining a constant thickness and decreasing weight therebetween, the cap being capable of being affixed to the blade for providing increased strength with controlled variation in weight from the root end to the tip end based upon the tapered width of the material thereof.